DISCUSSION PAPER FOR SOLUTION STRATEGIES
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I. THE PROGRAM SHOULD DEVELOP A METHODOLOGY FOR SIMPLIFYING THE PROCESS OF ALTERNATIVE GENERATION.

The CALFED Bay-Delta Program must identify and analyze a full range of credible alternatives. The task of identification and analysis of alternatives could become quite cumbersome, unless methods can be found to quickly reduce the number of theoretically possible solutions.

Assume that several ways exist to meet each implementation objective. Then, in theory we could create possible alternatives by putting together various actions aimed at meeting individual alternatives into packages. Thus, for example, if there are four possible general solutions to water supply, four possible solutions to ecosystem restoration, and so on, then we could create alternatives by combining different elements from each category. This can be written symbolically as: [supply solution$_a$ + ecosystem solution$_b$ + quality solution$_c$ + levee solution$_{d]}$ where a, b, c, and d can vary from 1 to 4.

Unfortunately, this method would generate 4^4 or 256 permutations. If each objective had 5 possible solutions, the number of permutations would be 625.

Clearly, we need a way of simplifying the process of alternative generation.

II. SIMPLIFYING THE IDENTIFICATION OF ALTERNATIVE SOLUTIONS.

The Program could dramatically reduce the number of possible permutations if it accepts that the method of water export and water management will dominate the character of various alternative packages. The following sections support this hypothesis.

1. Ecosystem restoration options are not fundamentally independent of the water export and water management alternatives.

Ecosystem restoration will be based upon four main components:

- Management of flows (volume, velocity, timing, location)
- Management of diversions (volume, timing, location, screening)
- Physical habitat restoration
- Management of environmental water quality

Of these, the management of flows and the management of diversions is largely determined by the water export and water management components of the alternative.

Physical habitat restoration is largely generic. That is, physical restoration will consist of changes to the physical configuration in (and out of) the problem area to boost various forms of habitat. These physical changes will be tailored to conform to the realities of the export and water management methods chosen, but will not differ fundamentally between possible alternatives. Indeed, many of the habitat restoration actions may not be specified in advance. Rather, authority may be vested in an agency to restore habitat based upon an adaptive management approach. The key point is that the Program is likely to settle on a single (best) generic approach to restoration. It will probably not propose fundamentally different approaches to restoration for consideration.

Management of environmental water quality has only a limited amount of independence. To a large degree, water quality patterns will be determined by the management of flows, the management of diversions, and physical restoration. Some independence exists however, in possible responses to pollution sources. For example, the Program could take a number of measures in response to high levels of salinity in the San Joaquin River. But these kinds of changes can be viewed simply as variations off of individual alternatives.

2. Water quality for users is almost completely determined by the water export, water management, and ecosystem restoration options.

As discussed above, for exporters and Delta diverters, water quality is determined by the location of the intake, the pattern of diversion, and the quality of the water at the intake. With a few exceptions, all of these factors are largely dependant upon the actions taken to restore the environment and, above all, the water infrastructure and operations. For example, with a particular through-Delta facility, we pretty much know what the quality of water will be. Then the question is how expensive it will be to treat that water. Similarly, isolated systems will have well defined raw water qualities.

Again, additional actions to deal with water quality will need to be incorporated into various alternatives (e.g., measures to deal with San Joaquin River salinity or to deal with discharge from Delta Islands). Nevertheless, these changes can be viewed as simple variations on a theme that is largely determined by other elements in the package.

3. The levee stability element is likewise largely dependant upon the export, water management and ecosystem elements.

Many of our actions with respect to levee maintenance will be determined by ecosystem and supply options. If we flood islands for habitat, then we are no longer concerned with future catastrophic flooding for those islands. If we invest in the creation of habitat within the islands, then a corollary is that we must maintain the levees to protect our investment. If we use the islands for storage, then levee protection is automatic. If we widen channels, then the flood control problems with levees may be reduced. The only fundamental issue remaining is the level of protection given to Delta islands which remain in traditional agricultural production or contain infrastructure. To some extent our answer to this question will depend on the mode of Delta transfer chosen (with isolated systems, the imperative for state funded protection is diminished). In any case, as with water quality, the remaining flexibility in implementation is probably not significant enough to justify creating a whole new class of

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options.

4. Institutional arrangements represent changes in the methods by which water and the environment will be managed, but do not represent fundamental changes in management choices themselves.

Water and the environment can be managed through a variety of institutional mechanisms. For example, environmental flows can be determined by regulations or by environmental water rights, or through purchases by an environmental water agency. The control of exports could be managed by a central agency, controlled by water rights, or determined by a market. The key point is that these alternatives are administrative variations. They do not necessarily change how and when water is stored, diverted or released. One solution strategy, then, would be to specify the physical layout of the solution (infrastructure, physical habitat, flow patterns, diversion patterns, levee maintenance, pollution control), then to apply various institutional strategies as variations.

For example: Water transfer strategies can be a component for any credible option. The nature and size of the market will, to some degree, be determined by the alternative under consideration (for example, with the current configuration, possibilities for transfers are somewhat limited). However, similar physical options could also have radically different institutional structures. For example, an isolated transfer facility could be built as an adjunct to the CVP and SWP. Alternatively, it could be built by investors and capacity sold on the market to the highest bidders. In either case, flow patterns through the facility would be largely determined by the Program and would therefore not differ significantly between these institutional variations.

III. STRATEGY FOR IDENTIFYING SEPARATE SOLUTIONS

If the assumptions made above are valid, then the number of major permutations is reduced down to the number of ways in which we can export and manage water. Then for each permutation, large numbers of variations might be proposed in an attempt to find the most attractive version of the alternative.

If so, then we should be able to develop simple criteria to guide the development of different permutations. One possible methodology for developing different alternatives might be as follows:

- Develop a generic program for the restoration of physical habitat. It will include guidelines for: (1) the types of habitat to be created; (2) the interrelationships between habitat types (3) necessary flow and water quality patterns to allow utilization of the habitat; (4) strategies for dealing with minor sources of entrainment such as Delta island intakes; (5) institutional arrangements for adaptive management; and (6) other generic elements).
- Select a water export and management option (conveyance, storage, operations, institutions). Acceptable options must meet the following criteria:
    - Reduce the conflict between environmental and out-of-stream beneficial uses by

shifting diversions patterns such that in-stream flows during important biological periods are adequate to support the restored habitat. This can be accomplished by (for example): (1) shifting diversion patterns to emphasize diversion of low value environmental flows (e.g., storm flows) and storing them so that high value environmental flows (e.g., spring flows) can be increased; (2) reducing demand (through conservation, reclamation, water transfers, etc.); or (3) reducing environmental needs for water through improved upstream habitat.

  - Reduce the conflict between the environment and out-of-stream beneficial uses by reducing the entrainment impacts of diversions. This can be accomplished by (for example): (1) various screening or gate alternatives; (2) shifting the location of the intakes; (3) shifting diversion timing to emphasize diversions during periods when fish are not likely to be entrained; and (4) through real time management of diversions.
  - No supply options should be otherwise incompatible with the generic environmental restoration program.
  - The option should assure that supplies are adequate to meet demands on a consistent basis. This can be accomplished either through supply enhancements (conveyance, storage, greater access to existing conveyance) or through demand management (conservation, reclamation, transfers).
  - The option should maintain or improve the predictability of supply. This can be accomplished through storage, regulatory feedbacks, and an improved market water transfer element.
  - Confirm that the option maintains or improves water quality.
- Adapt the generic environmental program to the supply option chosen. This includes invoking the equity objective (if water supply and quality needs are met at high levels, then ecosystem restoration goals should similarly be met at high levels and vice versa).
- Develop a levee element, based upon the ecosystem and supply elements for levees that have not already been addressed. Several elements may, in fact be possible, depending upon the amount of levee protection assumed posited.
- Develop a water quality element, based upon the ecosystem and supply elements that have not already been addressed. Again, several different elements may be possible here
- Develop institutional elements to the extent they are essential to the implementation of the alternative.
- If desired, create variations which assume different institutional management structures.

Now, each rough alternative (with its variations) can now be assessed and refined through an iterative process.